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FIXING ELEMENT FOR FIXING CORRUGATED TUBES TO A SUPPORT PART

Background of the Invention

Field of the Invention

The invention pertains to a fixing element for fixing corrugated tubes to a support part. The fixing element is connected to the support part by a fixing leg and includes engaging members that engage undercuts provided on the corrugated tube.

Reference to Related Art

Corrugated tubes are often used in the installation of electric lines or bundles of cables that extend or are installed along a support part. Due to the design of the corrugated tube (i.e., a tube with uniformly spaced apart circular grooves or ribs in its outer surface), the tubes are very flexible such that a bundle of cables can be arbitrarily installed in a space-saving fashion. For example, the tube may be installed such that it follows the shape of a support part. In order to fix a corrugated tube with a bundle of cables situated therein at its intended location, the tube needs to be fixed to the support part at certain intervals. For this purpose, the ribbed outer surface of the corrugated tube is typically provided with two undercuts that extend parallel to one another in the longitudinal direction in a mirror-inverted fashion. Fixing elements are then arranged on the support part at certain intervals and are engageable with the undercuts of the tube.

Corrugated tubes of this type are available with various diameters. In corrugated tubes with a relatively small diameter and an accordingly thin wall,

the above-mentioned undercuts also are relatively small such that they only provide a small engaging surface for a fixing clamp. Therefore the connection between the undercuts of the corrugated tubes and the fixing element may not be sufficiently secure to ensure proper installation of the tube.

Summary of the Invention

The invention is directed to a fixing element for securely and reliably attaching corrugated tubes having a relatively small diameter and undercuts (with an accordingly small depth) to a support part.

According to the invention, there is disclosed a fixing element having a guiding rail that is rigidly connected to the fixing leg of the fixing element. A slide with a retainer lock is tapered in the inserting direction and rigidly arranged on the slide and can be displaced in the guiding rail. Engaging edges that extend toward one another in a mirror-inverted fashion are formed on one side wall of the guiding rail and on the retainer lock surface of the retainer lock which is situated opposite to the aforementioned side wall of the guiding rail. The engaging edges are engageable with undercuts on the corrugated tube to be fixed. The undercuts extend parallel to one another in the longitudinal direction in a mirror-inverted fashion. The distance between the engaging edges is reduced when the slide is inserted into the guiding rail.

The slide can preferably assume two positions in the guiding rail. A disengaged position is characterized by the slide being partially pulled out of the guiding rail and the distance between the engaging edges being at its

greatest. An engaged position is characterized by the slide being inserted into the guiding rail and the distance between the engaging edges being reduced.

In the disengaged position of the slide, the undercuts of the corrugated tube to be fixed are engaged with the engaging edges that are integrally formed onto one side wall of the guiding rail and the opposing retainer lock surface of the retainer lock. Preferably, when the slide is inserted into the guiding rail, the distance between the two engaging edges is reduced (due to the wedge effect of the retainer lock arranged on the slide) such that the engagement with the undercuts on the corrugated tube is tightened and a secure retention of the corrugated tube is ensured.

Preferably, the guiding rail contains bottom and side walls with guiding surfaces for the slide. An engaging tab that is slightly bent upward and contains an upwardly directed locking tab is advantageously formed on the base of the guiding rail by means of recesses. Preferably, the engaging tab can be elastically engaged with notches provided on the underside of the slide which defined the disengaged position and the engaged position of the slide. Therefore, the slide is held in the guide rail in a captive fashion in its disengaged position and locked in its engaged position such that an unintentional disengaging of the corrugated tube from the fixing element is prevented.

According to a preferred embodiment of the invention, the slide has a flat base part that carries the retainer lock on its upper side. The slide is guided on guiding surfaces formed by the side wall of the guiding rail on one side and

by a step of the side wall of the guide rail on the other side by an outer retainer lock surface and an inner lateral surface of its base part.

The slide is preferably guided on one side in a rectangular groove formed in the side wall and on the other side in a rectangular groove formed underneath the step, namely by guiding ridges that laterally protrude from the base part.

The guiding surfaces for the slide (which are formed on the side walls of the guiding rail) extend transversely in reference to the center line of the base. The base part of the slide transversely extends at the same angle. Therefore, one engaging edge formed on the inner retainer lock surface and the opposing engaging edge formed on one side wall of the guiding rail above the step that forms a guiding surface for the base part of the slide extend parallel in reference to the center line of the base of the guiding rail. Due to these measures, a superior clamping effect of the engaging edges on the undercuts of the corrugated tube is achieved.

Brief Description of the Drawings

The invention is described in greater detail below with reference to the enclosed figures; the figures show:

Figure 1, a side view of a corrugated tube with undercuts for fixing the corrugated tube which extend in the longitudinal direction on its underside;

Figure 2, a view of the corrugated tube shown in Figure 1 which is directed onto one opening of the corrugated tube;

Figure 3, a perspective view of a fixing element according to the invention;

Figure 4, a side view of the fixing element shown in Figure 3;

Figure 5, a top view of the fixing element shown in Figure 3;

Figure 6, a cross section through the fixing element along the line of section VI-VI in Figure 4, namely with the fixing ridge clamped in position;

Figure 7, a top view of the base body of the fixing element shown in Figure 3;

Figure 8, a longitudinal section through the base body of the fixing element along the line of section VIII-VIII in Figure 7;

Figure 9, a cross section through the base body of the fixing element along the line of section IX-IX in Figure 8;

Figure 10, a top view of the slide of the fixing element shown in Figure 3;

Figure 11, a side view of the slide shown in Figure 10, and

Figure 12, a cross section through the slide along the line of section XII-XII in Figure 11.

Detailed Description

Referring now to Figures 1 and 2 there is shown a corrugated tube 1 in the form of a side view and a view that is directed onto one of the tube openings. The ribs 3, which provide the corrugated tube 1 with its flexibility, are produced by arranging circular grooves 2 in the outer surface of the tube. In Figures 1 and 2, the underside of the corrugated tube 1 is provided with two

undercuts 4 that extend parallel to one another in the longitudinal direction in a mirror-inverted fashion such that a fixing ridge 5, which is integrally formed onto the outer surface of the corrugated tube 1, is created. The corrugated tube 1 can be cut open in the longitudinal direction such that a bundle of cables to be installed can be placed into the corrugated tube 1. One characteristic of the plastic material that is preferably used for the corrugated tube 1 is that the slot closes again after a bundle of cables is placed into the corrugated tube.

The corrugated tube 1 can be inserted or pressed into a fixing element that is arranged on a support part (not shown) by its fixing ridge 5 in such a way that engaging members provided on the fixing element engage behind the undercuts 4 of the fixing ridge 5 to secure the corrugated tube 1 on the support part. The slot for inserting the bundle of cables into the corrugated tube 1 is preferably produced outside of the fixing ridge 5, in particular, on the opposite side of the corrugated tube. Due to this measure, one or more bundles of cables can also be subsequently inserted into the corrugated tube 1. Naturally, it would also be possible to pull a bundle of cables through a non-slotted corrugated tube 1 and to anchor the corrugated tube on the fixing element with its fixing ridge 5. In special applications, it may be necessary to arrange the slot in the fixing ridge 5. In this case, the slot is preferably produced along a center line of the fixing ridge 5. After the fixing ridge 5 with its undercuts 4 is engaged with the engaging members of a fixing element, the slot is compressed such that the corrugated tube 1 is held closed. This may provide an additional safety in certain instances.

In corrugated tubes 1 with a relatively small diameter and a relatively thin wall 6, the undercuts 4 also are accordingly small such that they frequently do not provide a sufficient engaging surface for known fixing elements. Therefore, it is difficult to ensure that these small tubes are properly secured to the fixing element and to the support part. The fixing element 7 according to the invention serves for eliminating this problem.

Referring now to Figure 3 there is shown a perspective representation of a fixing element 7 constructed in accordance with the present invention. Figure 4 shows a side view of the fixing element 7. Preferably, the fixing element 7 includes a base body 8 having a guiding rail 9 and a fixing leg 10, and a slide 11 having a retainer lock 12 (see also Figures 7-12). Figures 4, 6, 8 and 9 indicate that the base body 8 contains a fixing leg 10 that can be elastically deformed. The base body 8 is insertable into an opening of a support part (not shown) with this fixing leg 10 and anchored therein. A circular collar 13 situated above the fixing leg 10 preferably serves to support the base body 8 and the fixing element 7 on a surface of the support part.

Preferably, the guiding rail 9 extends in the longitudinal direction and is situated above the collar 13. The guiding rail 9 has a cuboid shape, in the upper side of which is arranged a recess 14 that transversely extends in the longitudinal direction. This means that a base 15 and two side walls 16, 17 remain, wherein one side wall 16 widens in the inserting direction P of the slide 11 and the other side wall 17 is tapered in the same direction.

The tapered side wall 17 contains an inwardly directed step 18 that is aligned with the base part 19 of the slide 11 in the connected state to form a guiding surface for the slide 11 and a common support surface for the fixing ridge 5 (see Figure 6). A rectangular groove 20 that is raised in reference to the surface of the base 15 is formed underneath the step 18. A free end of the side wall 17 is undercut in such a way that a tapered engaging edge 21 is formed that is directed inward and linearly extends in the longitudinal direction. The engaging edge 21 is able to engage behind one of the undercuts 4 on the fixing ridge 5 of a corrugated tube 1 as indicated in Figure 6.

A rectangular groove 22 that is also raised in reference to the surface of the base 15 is arranged in the opposite side wall 16 that widens in the inserting direction P, namely at the same height as the base part 19. An engaging tab 24 that is slightly bent upward and contains an upwardly directed locking tab 25 is formed on the front end of the base 15 by means of recesses 23 arranged on both sides of the tab 25 (see also Figures 7 and 8).

The slide 11 is arranged such that it can be displaced in the guiding rail 9 of the base body 8 (see also Figures 10-12). The slide 11 preferably includes an essentially flat base part 19 that is inclined at an angle toward an actuating projection 26 which is integrally formed onto the base part 19 in the shape of a T. Preferably, the angle of the slide 11 corresponds to the transversely extending recess 14 in the guiding rail 9 (see Figure 10). A retainer lock 12 that is tapered in the inserting direction P is integrally formed onto the surface of the base part 19. Preferably, the retainer lock 12 is provided with its wedge

shape because the outer retainer lock surface 27 extends at the same angle as the base part 19 while the inner retainer lock surface 28 extends perpendicular to the actuating projection 26 (see Figure 10). The inner retainer lock surface 28 is undercut in such a way that, as soon as the slide 11 is inserted into the guiding rail 9, a second engaging edge 29 is created in a mirror-inverted fashion in reference to the engaging edge 21 on the side wall 17 of the guiding rail 9. As indicated in Figure 6, this second engaging edge 21 is preferably engageable behind the second undercut 4 on the fixing ridge 5 of a corrugated tube 1. A lateral surface 31 of the base part 19 that is arranged opposite to the retainer lock surface 27 preferably adjoins the lateral surface of the step 18 in the side wall 17 of the guiding rail 9.

The slide 11 can assume a disengaged position and an engaged position in the guiding rail 9. For this purpose, the slide 11 is preferably provided with two notches 32 or recesses that are spaced apart on its underside in the longitudinal direction. A locking tab 25 on the elastic engaging tab 24 of the guiding rail 9 is able to engage into these notches 32 (see Figures 11 and 4). A rear notch 32 preferably is arranged directly adjacent to the actuating projection 26. Figures 4 and 5 show the fixing element 7 in the disengaged position of the slide 11, i.e., the locking projection 25 of the engaging tab 24 is engaged with the front notch 32 which is situated on the underside of the slide 11 at approximately half its length in the embodiment shown (Figure 11). This means that the slide 11 is respectively held in the base body 8 and the guiding

rail 9 in a captive fashion in its disengaged position. In this case, the fixing element 7 is in its standby position.

Figure 3 indicates that the slide 11 is guided in the guiding rail 9 by means of guiding ridges 30 and 33 that laterally protrude from the base part 19. For this purpose, one rectangular groove 22 is arranged in the side wall 16 of the guiding rail 9 and another rectangular groove 20 is arranged underneath the step 18. The guiding ridges 30 and 33 are able to engage and slide into these grooves.

When using the fixing element 7, the fixing ridge 5 of a corrugated tube as shown in Figures 1 and 2 (e.g., a corrugated tube into which a bundle of cables was inserted in the previously described fashion) is inserted or pressed into the guiding rail 9 that contains the disengaged slide 11 such that the opposing engaging edges 21 and 29 on the guiding rail 9 and the retainer lock 12 encompass the fixing ridge 5 of the corrugated tube 1 at the undercuts 4 (see Figure 6). Subsequently, the slide 11 is inserted into the guiding rail 9 (in the direction of the arrow P) until the locking tab 25 of the elastic engaging tab 24 engages into the notch 32 situated closer to the actuating projection 26 on the base 15 of the guiding rail 9 to lock the slide 11 into an engaged position. Due to the wedge effect of the retainer lock 12, the distance between the engaging edge 21 on the side wall 17 of the guiding rail 9 and the inner retainer lock surface 28 of the retainer lock 12 is reduced when the slide 11 is inserted into the guiding rail 9 (see also Figure 12). Therefore, the engaging edges 21 and 29 are so tightly engaged with the undercuts 4 of the fixing ridge 5 of the

corrugated tube 1 that a secure retention of the corrugated tube 1 in the fixing element 7 and consequently on a not-shown support part is also ensured.

I claim: